National Security Issues Underground

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Overview

- What is National Security research?
- Lower and lower levels of radioactivity measurement are required immediately

- The existence of a US underground facility will greatly improve the science and technology of National Security measurements in the future

What *is* National Security Research?

Scientists and engineers working to create technology to achieve national requirements

- Proliferation Detection
  - Conduct research to overcome the technology barriers to deter proliferation;
  - Develop supporting technologies to monitor current and future arms control agreements and treaties; and
  - Sustain through research the next generation scientific and technical capability to deter nuclear weapon proliferation.
- Nuclear Treaty Verification / Monitoring
  - Developing technology to support operational organizations engaged in monitoring treaties and agreements

Classical Radiation Detection in Support of National Security

- Treaty Monitoring, International Example
- Non Proliferation Treaty, Additional Protocol
  - Environmental samples are measured to verify compliance with a treaty
  - Samples are taken on-site, transported to a laboratory
  - Pattern of negative results indicates compliance
  - A single positive measurement may raise alarms
- Conclusion
  - Very low detection limits are very desirable
- An illustrative example: The IAEA lab at Seibersdorf, Austria

International Atomic Energy Agency

Environmental Sampling for Safeguards:

Verifying the absence of evidence

Stephan Vogt, David Donohue, and Yusuke Kuno

Safeguards Analytical Laboratory

Agency's Laboratories Seibersdorf

International Atomic Energy Agency

Environmental Sampling Field Trial Exercises

Swipe Sampling
from Vegetation

Swipe Sampling
from Process Equipment

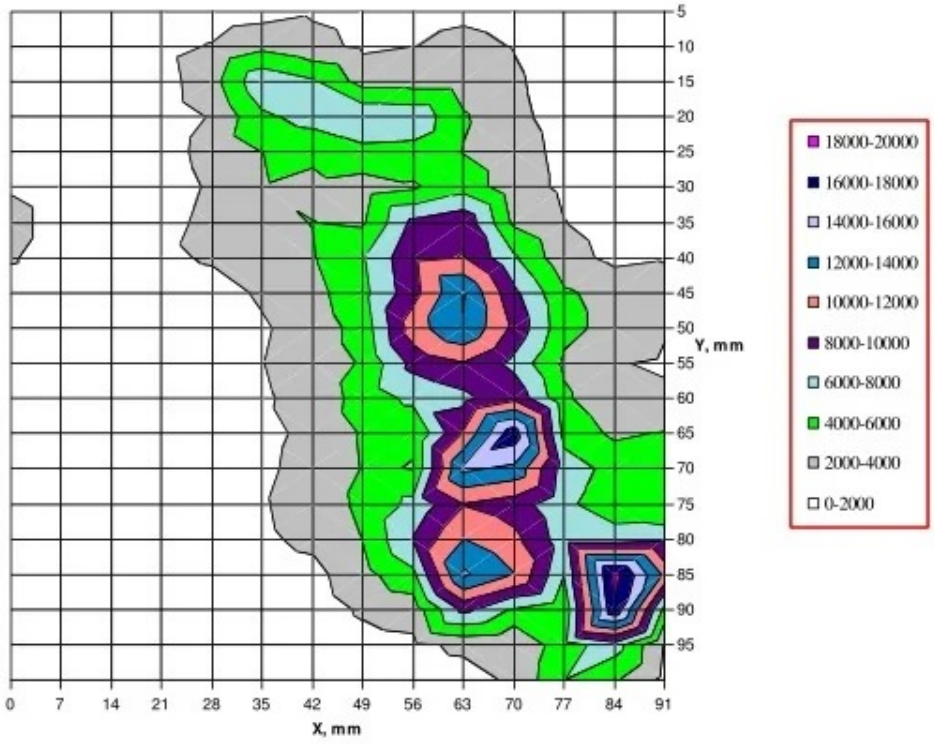
High Volume Water Sampling
with a Special Filter

Sampling of
Surface Soil

XRF Screening of Environmental Swipe Samples

Uranium profile for sample 20287-03-07

(U_{tot}=0.87 mg)



"Topographic map" of uranium distribution on swipes

Classical vs. Next Generation

- How many atoms of xenon in air?
  - 87 atoms per billion
- In 8 hours, we collect enough air to make 3 cc
  - About 1 x 10^{20} atoms, or 100,000,000,000,000,000,000
- Then we look for 3000 atoms of ^{133}Xe, ^{135}Xe, etc
  - Indicative of an underground weapons test
  - Perhaps a thousand times more sensitive than previous example
- The Automatic Radioxenon Sampler / Analyzer
  - Part of the International Monitoring System
  - Currently being demonstrated in Guangzhou, China
- Imagine what we could do underground!
  - Cosmic ray background is as much as a million times less

Relationship to Science Underground

- First, neutrino research underground trains our sharpest assets
  - Dr. Craig Aalseth, Physicist, Principal Investigator, Radiological and Chemical Sciences, PNNL (Sturgis)
  - Bob Thompson, Electrical Engineer, Leader, Radiation Portal Monitoring Project, PNNL (Yankton)
  - Both are SDSM&T graduates
  - Both are veterans of germanium double-beta decay
- Second, underground science technology goals frequently match National Security research goals

In closing,

- For National Security research, we need
  - A location that is deep,
  - Within the US,
  - With enough space to allow a separate area,
  - Which is a secure facility.
- Co-located pure science experiments are a boon
  - There isn't enough cross-pollination between the National Security and pure science communities
- And by the way:
  - We have needed NUSEL badly and for a long time